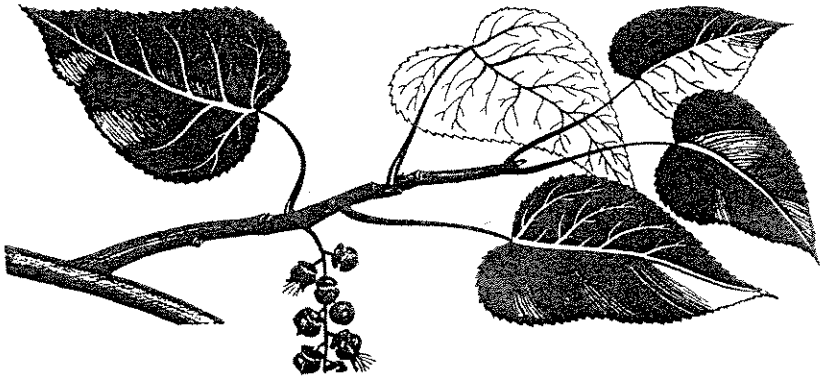
SCOTT RIVER RIPARIAN WOODLAND REVEGETATION DEMONSTRATION PROJECT

Final Report FY 1994



by

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for

SISKIYOU RESOURCE CONSERVATION DISTRICT

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Drawings of riparian plants from Sudworth (1908)

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ABSTRACT

The purpose of this project was to demonstrate techniques that could lead to the successful restoration of riparian woodland along the Scott River and elsewhere at a reasonable cost. Three sites were selected for the projects on the basis of need for restoration (i.e.the lack of vegetation), the applicability of the site as a demonstration area (how typical of other areas it was), exclusionary fencing, and the willingness of the landowner to participate.

Three woody plant species, black cottonwood (*Populus nigra*), willow (*Salix* sp.) and Ponderosa pine (*Pinus ponderosa*) were chosen for planting on the site. These species were known to occur naturally in the riparian zone of the river, were relatively easy to grow in the available time, would produce a variety of habitats when mature, and would grow tall enough to provide shade for the water. Cuttings of cottonwood and willow were obtained in January and were placed in styrofoam containers at CalForest Nursery's greenhouses in Scott Valley. Containerized pine seedlings were grown from local seed the previous season. A total of 4,000 seedlings were planted in June 1994, with drip irrigation provided to each plant. Seedling protectors were placed on each cottonwood and many willow plants as deer browsing was heavy at one site.

As of November 1, 1994, survival on the three planting sites ranged as follows: cottonwood from 19% to 70%; pine from 52% to 91%; and willow from 7% to 80%.

Several conclusions were made. An adequate water supply for at least the first growing season allows easy establishment and rapid growth of planted seedlings. A small amount of fertilization is also beneficial but not essential. The water needs to be supplied by a system which is more reliable and easier to manage than a gasoline pumping plant pumping from the river. Guidelines are recommended, based on this first year experience, for future riparian planting projects.

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INTRODUCTION

Restoration of riparian vegetation could potentially provide large, long-term benefits to the Scott River and Scott Valley agricultural productions activities by allowing the river to rebuild its banks during high water, rather than dig into raw unprotected streambanks and threaten productive agricultural land. As the banks rebuild themselves, the river channel is narrowed and the high velocity flows are confined much narrower, better defined channel (Lisle, 1989). During high flows, the river overflows its banks into the riparian woodland areas where the water is slowed by the vegetation and drops its load of sediment. The slowing of the water also greatly reduces the potential damage that it can do to adjacent agricultural land. The narrowing of the river channel provides benefit to fish habitat as will by creating cleaner instream gravel, deeper pools, and cooler water in the summer time due to improved shading the the river surface.

The Scott River, tributary to the Klamath River in Siskiyou County, California, passes through the alluvial Scott Valley for 34 miles of its total length of 58 miles. Prior to the arrival of Europeans settlers in the mid 1800's, the river supported extensive riparian woodlands in the valley. By the mid 1900's these woodlands were virtually gone due to a steady attrition from a variety of causes. These factors include: flood damage; extensive cutting for firewood and fuel for steam powered farming equipment (Dr. Jim Young, USDA, pers. comm.); removal for conversion of land to agricultural production; clearing of the river channel for flood control; removal for flood control and for levee construction; disease; and reduction of replacement vegetation due to grazing pressure.

The purpose of this project was to demonstrate techniques that could lead to the successful restoration of riparian woodland along the Scott River and elsewhere at a reasonable cost. Such restoration efforts have been undertaken elsewhere with some success. The Nature Conservancy has undertaken successful restoration of riparian vegetation along the Kern River in Kern County, California, and along the Sacramento River in California's Central Valley. In both of these sites, they use extensive irrigation systems on productive soils to establish native riparian species. They identify irrigation, fertilization, weed control and browse protection as the keys to their success (Welsh, 1992; TNC, 1993; Griggs, 1994; Loudon, 1994). The U.S. Army Corps of Engineers funded a very costly demonstration of techniques along the Sacramento River which was largely unsuccessful, apparently due to the premature termination of irrigation (Chainey, Land & Mills, 1989).

A literature search identified other riparian restoration evaluations (Anderson et al, 1984; Beland & Braun, 1954; Giordanoa, 1993; Mahoney & Rood, 1993; Rood & Mahoney, 1993; Segelquist et al, 1993; Stanley et al, 1989). In addition, a variety of willow and cottonwood propagation methods were found in the literature (Carlson, 1979; Carlson et al 1992; Furniss, 1993; Hoag, 1993; Hoag, 1994; Lambert et al, 1990; Polish Academy of Sciences, 1976; Read, 1958; USSCS, 1989; USFS, 1982; USACE, 1986).

Efforts to establish riparian vegetation along Shasta River without any irrigation or care of any kind have been largely unsuccessful (Bill Chesney, CDFG, pers. comm.), as have some efforts on the Scott River. Alvin Lewis, formerly of SCS in Scott Valley, has successfully established vegetation at projects sites in the Scott Valley using irrigation and in many cases, extensive protection from browse damage. To date, most of the planting efforts along the Scott and Shasta Rivers have been limited to a narrow band immediately adjacent to the river. As described above, this projects is to demonstrate the benefits of establishing a more extensive riparian woodland, to provide additional benefits as described above.

Riparian Tree Species of Scott Valley

Riparian forest communities are distinctive along each river system. Black cottonwood *(Populus trichocarpa)* was apparently the dominant native tree species along the Scott River, with one distributution map indicating stands more than two miles across in the central portion of Scott Valley (see Figure 1). It can become 120 to 180 feet tall. Historic photographs of the river from the early 20th century confirm its dominance downstream of Horn Lane Bridge. While Fremont cottonwood (*Populus fremontii*) was prominant in the pristine riparian forest of the Sacramento Valley, it is uncommon in the Klamath Mountains and is only found in a disjunct stand along Moffett Creek near Highway 3, which is the most northern limit of the species in California (Griffin and Critchfield, 1972).

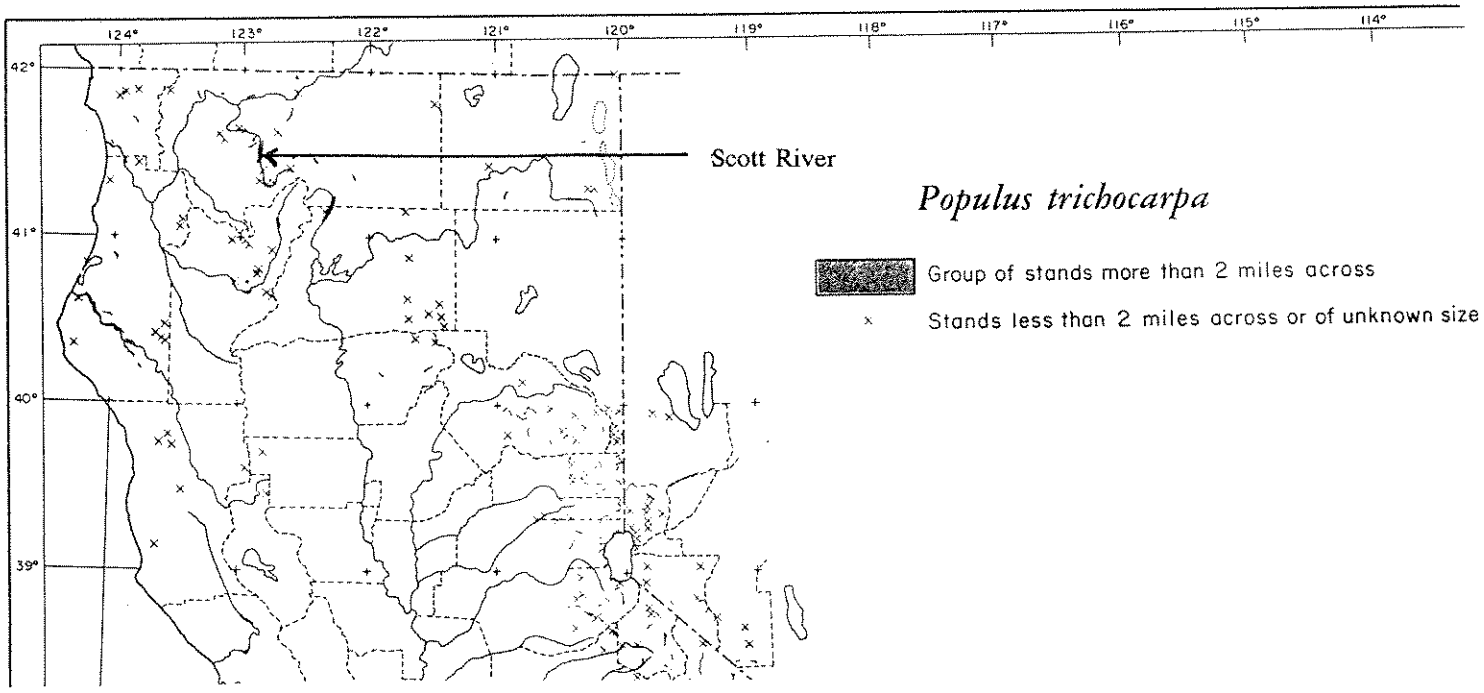
Ponderosa pine (*Pinus ponderosa*) was also distributed extensively in Scott Valley (Fig. 1). It was cleared for agriculture in the 19th and 20th centuries near the river because it reportedly shaded the adjacent fields in the spring and kept the ground too frozen for spring plowing with horse-drawn plows (Dave Horn, pers. comm.). Isolated remnant trees are still found near the river today.

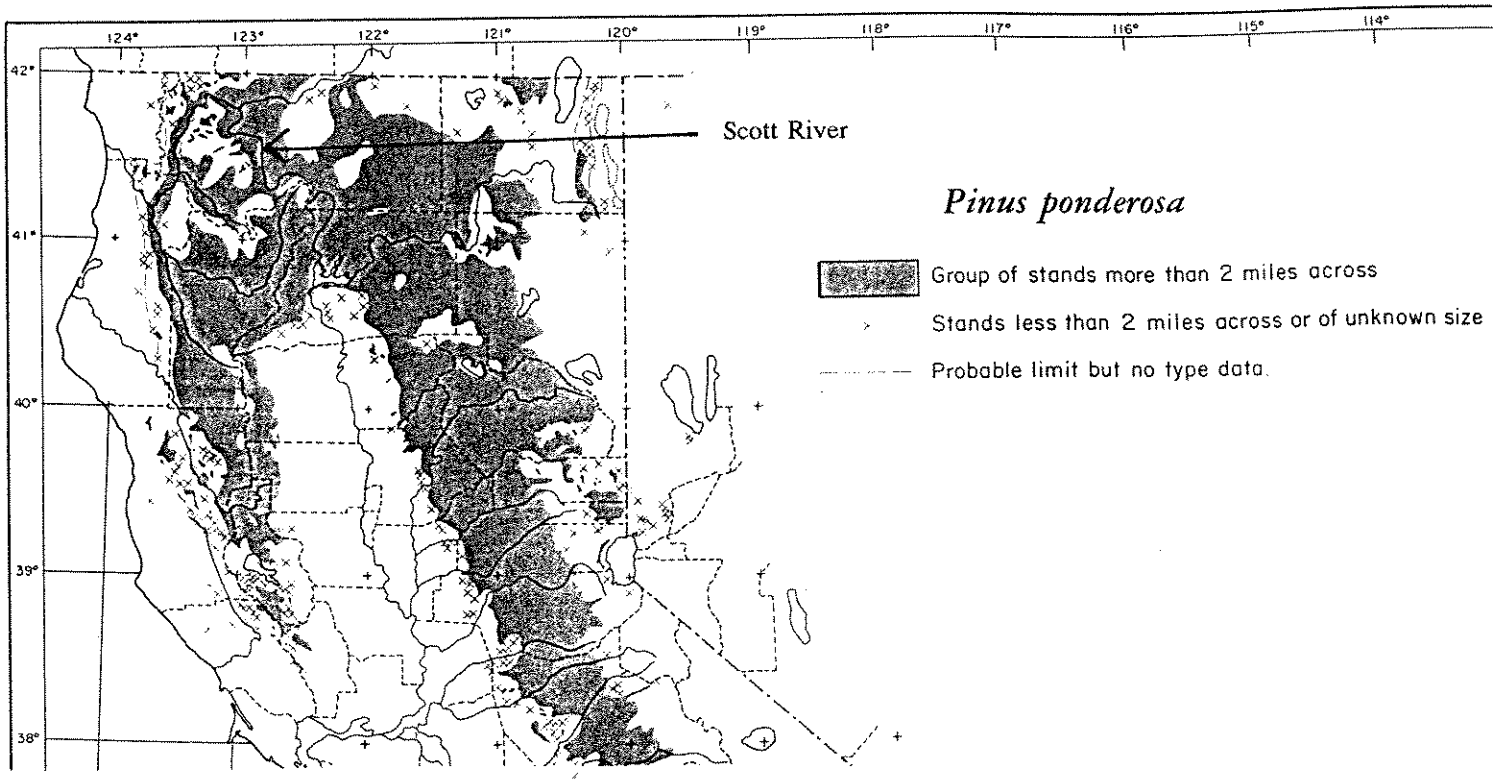
Willows are found along the Scott in small tree and shrub form. The native tree appears to be Pacific or Yellow Tree willow (*Salix lucida ssp. lasiandra*), and can grow to 50 feet depending on the site. It appears to be more flood tolerant than other native willows (Faber & Holland, 1988; USSCS, 1991). Shrub forms include the yellow willow (*Salix lutea*) (6-15 ft. tall) and the Arroyo willow (*Salix lasiolepsis)* (6-30 ft. tall) (Marla Knight, USFS, pers. comm.).

Other native riparian tree species which were recently identified at some sites along the Scott River in Scott Valley include: white alder (*Alnus rhombifolia*), western black willow (*Salix sp.*), smooth willow (*Salix sp.*), wild cherry (*Prunus sp.*), black oak (*Quercus kelloggii*), hawthorn (*Crataegus douglasii*), and quaking aspen (*Populus tremuloides*) (Lewis, 1992). Native shrubs, forbs, and grasses are also found.

Non-native naturalized and exotic riparian tree species are also found along the Scott River: black locust, honey locust, golden willow, Russian olive, walnut, hybrid poplar, silver poplar,

Figure 1. Historic Distribution of Black Cottonwood (*Populus trichocarpa*) and Ponderosa Pine (*Pinus ponderosa*) in Scott Valley, Siskiyou County. (Griffin & Critchfield, 1972.)





boxelder, silver maple and others (Lewis, 1992). Some of these plants are varieties developed by USDA Soil Conservation Service nurseries.

History of Riparian Planting in Scott Valley

In 1944, aerial photography of the Scott River reveals little riparian vegetation in Scott Valley. Following several floods and some serious streambank erosion in the valley, the Siskiyou Soil Conservation District (now Resource Conservation District) was formed in 1949. Bank protection was its primary activity, with the assistance of USDA Soil Conservation Service (SCS, now Natural Resource Conservation Service) staff. In the early 1950s, local newspaper articles reported that SCS engineers encouraged vegetative planting to help stabilize banks in conjunction with mechanical methods (Etna *Western Sentinel*, 1952 and 1954).

A complete record of SCS directed treatments cannot be found. Scattered records indicate the following partial planting history:

- In 1952, the SCS nursery provided 19,000 snowberry plants [ ], which were planted along the Scott and minor streams. This species was noted as being native in Scott Valley and "not affected by oystershell scale which has killed many of the willow and cottonwood." Planting was by farmers and ranchers, assisted by SCS, Calif. Div. of Fish and Game, and Fort Jones 4-H Club.
    - Apparently, none of these plantings has survived. As of 1992, a riparian inventory along the Scott River did not list any "snowberry" (Lewis, 1992).

- Golden willow, "Southern-wood" (unknown species), and matrimony vine were other species encouraged by SCS for planting in the early 1950s. The golden willow was touted as having "a more vigorous rooting system, but will not sucker and spread like the native willow". This lack of spreading was considered to be an attribute since it wouldn't invade irrigation ditches and wetlands. It was also praised for not moving out into the stream "to catch sand and gravel", which in those days was in contradiction to the clean channel approach to flood control.

- Nearly 5,000 feet of streambank along the Scott River were planted in March and April 1954 at Star Ranch in conjunction with tree revetment work. Two and three rows of golden or native willow were planted on the lower edge of banks or in the open spaces in the tree revetments, with several rows of snowberry and matrimony vine planted in the area above the willows.

- In an undated newspaper article in the SCS files (1960s?), SCS was noted for distributing for free 64,000 plants to farms in Scott Valley for streambank planting: matrimony vine, snowberry, golden willow, and multiflora rose.

    - In 1992, golden willow was found as a dominant species on 37 sites (averaging 22-25 feet height) and as an understory species on 11 sites; matrimony vine was located as understory on 40 sites of 373 inventoried (Lewis, 1992).

METHODS

Site Selection

An excellent inventory of potential restoration sites was conducted by Alvin Lewis for the Siskiyou RCD and published in 1992 as the "Scott River Riparian Zone Inventory and Evaluation". This report indicates fenced properties, riparian vegetation species and age composition, landowner willingness, and streambank condition. Of 373 sites evaluated along the Scott River in the valley, only two were considered "nearly pristine". Within the inventory study area, the study showed a potential for 200 acres of woodland in the Scott Valley without impinging on land currently utilized for agricultural production.

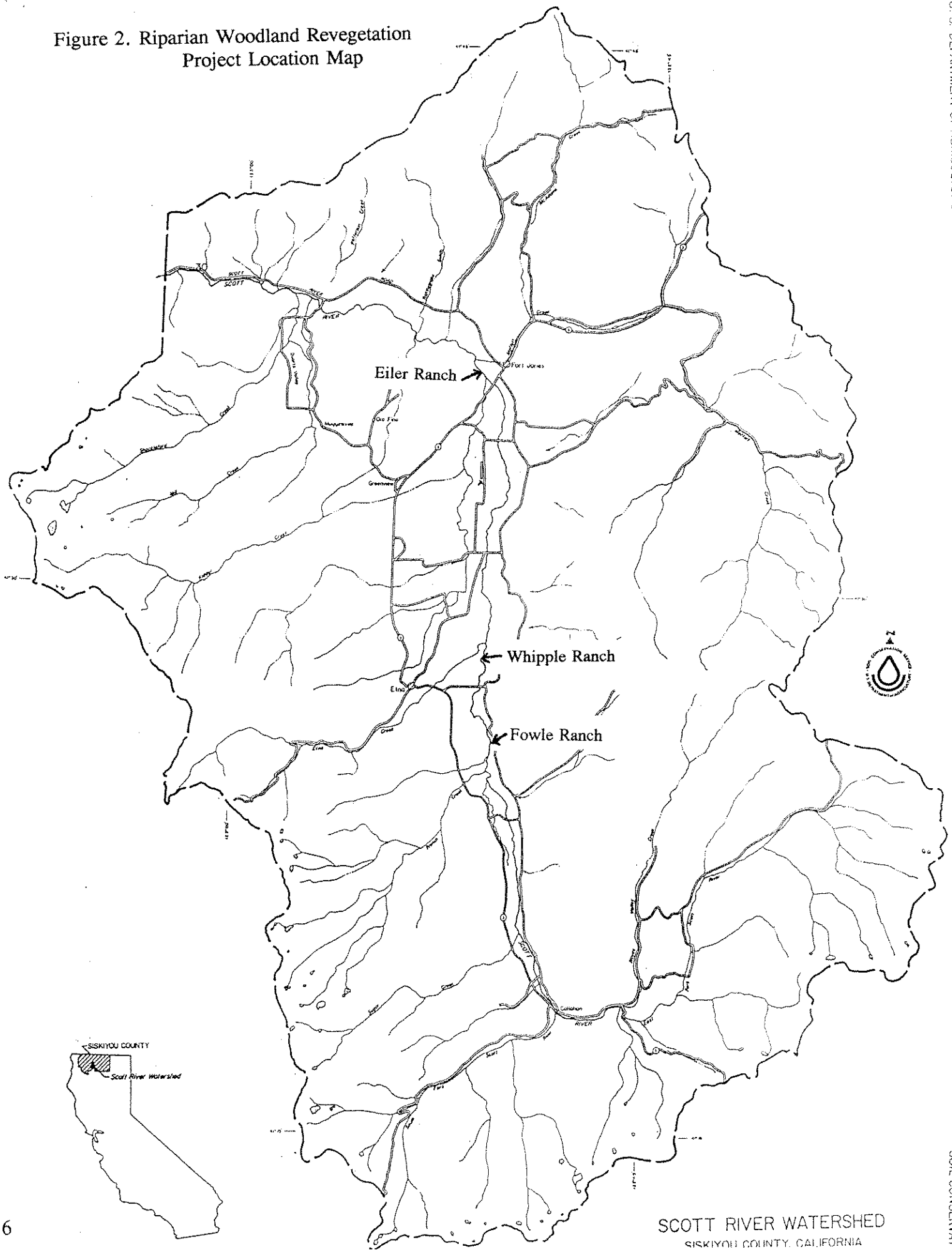
Three sites were selected for the projects on the basis of need for restoration (i.e.the lack of vegetation), the applicability of the site as a demonstration area (how typical of other areas it was), exclusionary fencing, and the willingness of the landowner to participate. On this basis three sites were chosen: one on the Ken Fowle Ranch above Horn Lane (River Mile 46.5), one on the Keith Whipple Ranch below Horn Lane (RM 42.5), and one on the Eiler Ranch (aka Scott Valley Ranch) below the Highway 3 bridge north of Fort Jones (RM 29). These sites are identified on the map in Figure 2.

The Fowle Ranch site consisted of a strip along the east bank of the river about 150' wide (max.) and 500 feet long. Most of the planting area was on the highwater flood plain, with a small part in a low water bar area and a part along a soil covered rip-rap and levee area. The soil on the site was generally a mix of sand and gravel with some cobble size rocks. Water was provided to the site by pumping out of the river and out an adjacent pond when the river dried up.

The Whipple Ranch site consisted of about and acre in a field adjacent to an old channel of the river and a half acre on high bars in the floodplain area of the river on both sides of the same old channel. The soil in the field portion ranged from pure sand to a silt loam; the soil in the bar portion ranged from fine sand to gravel. Weed competition was extensive in the field areas, but only moderate in the bar areas. This site suffered from serious deer browse due to the presence of approximately 4 resident deer on the site. Water was constantly available on the site from the ranch irrigation system.

The Eiler Ranch site consisited of about an acre of bar area ranging from 3' to about 8' above the normal low water levels. The soil ranges from sand to coarse gravel, with extensive grass competition in some areas. Water was pumped from the river until the river level dropped below the surface. A perforated pipe driven into a hole in the river bed provided a modest supply of water after the disappearance of the surface flow.

Figure 2. Riparian Woodland Revegetation Project Location Map



Plant Material

Three woody plant species, black cottonwood (*Populus nigra*), willow (*Salix* sp.) and Ponderosa pine (*Pinus ponderosa*) were chosen for use on the site. These species were known to occur naturally in the riparian zone of the river, were relatively easy to grow in the available time, would produce a variety of habitats when mature, and would grow tall enough to provide shade for the water. The black cottonwood and willow were grown from locally obtained cuttings. The ponderosa pine were grown from seed collected in the Scott Valley. Greenhouse facilities at CalForest Nursery in Etna were used for propagation.

All plants were grown in multi-celled styrofoam containers called a "Deep 4" [1 ¼ x 6 inches deep, density of 71 per sq. ft.]. The ponderosa pine were packed in February and were kept dormant by refrigerating at 34 °F. until just before planting. The cottonwood and willow cuttings were taken in January, and the plants were grown under greenhouse conditions until shortly before planting.

Irrigation System

All plants were irrigated with a drip system. The drip pipe was 16mm tube with internal 1/2 gallon per hour drippers spaced 5 feet apart. The tubes were supply through strainer connections from a 3/4 PVC mainline to the water source. On the Keith Whipple Ranch, the water source was the ranch mainline which is pressurized continuously throughout the summer. Water was supplied to the drip line through a 25psi pressure regulator. At the other two sites, water was supplied from the river by a small, 2 cycle gasoline driven pump through a 100 micron line filter.

The drip lines were laid out approximately 10 feet apart for whatever distance was available up to a maximum of 300'. A total of 15,000 feet of drip line was used. Plants were planted after the irrigation system was installed and allowed run for a day to saturate the ground. The plantings were irrigated virtually continously throughout the summer at Whipple's, whereas at Fowles and Eiler's, water was applied every other day for the first two to three weeks, then tapered off to once a week in August and September.

Animal Protection

Plastic mesh tubes (3"x18" size; "Vexar" trade name) were placed over all of the cottonwoods and a portion of the pines to protect from deer browse and othe potential animal damage problems. The tubes were installed in the standard way with a bamboo stake threaded down through the mesh and inserted into the ground. A literature search and inquiries of other restoration projects led to the conclusion that other types of seedling protection devices had drawbacks or were too expensive (Buckhouse, 1984; Windell, 1992; Welsh, 1992; TNC, 1993).

Planting

Trees were planted on all three sites in early June, 1994. The late planting date was primarily due to the time required to obtain adequate root growth on the cottonwoods. Additional cottonwoods were planted on the Keith Whipple Ranch in early July.

The ponderosa pine were planted mostly in the higher and drier areas, while a higher proportion of cottonwoods and willow were used in the areas closer to the river and the water table. Planting was done with dibbles, or when necessary, with a mattock and shovel. Most of the planting was relatively easy, except on a very cobbley run on the Fowle Ranch where rocks had to be dug out to provide a planting space.

Some scalping was required at all sites to temporarily remove competing vegetation. A relatively small scalp (18"x18") was used because it was thought that the availability of irrigation would make the competing vegetation less of a problem.

A total of 4,000 trees were planted. Originally, 8,000 trees were proposed but the severe drought conditions and need for additional dripline and more frequent watering led to the conclusion that it would be better to plant fewer trees and provide more intensive care. Photographs of various aspects of the project can be found in Appendix A.

RESULTS AND DISCUSSION

Initial survival on all sites was satisfactory. There was essentially no early mortality in the pine on any of the three sites. The cottonwood suffered very little initial mortality at Whipple's, but suffered about 25% early mortality at Fowle's and Eiler's. The early mortality at these sites was due to a combination of marginally inadequate root development in some of the plugs, competing vegetation, and lower available water due to the use of intermittent irrigation with the gasoline pump.

Following the first season, the seedling survival for each site and species ranged from 7% to 91%, as noted in Table 1 below.

Table 1. Seedling Survival by Site and Species, 11/1/94.

Site	Cottonwood	Pine	Willow
Whipple	70%	91%	80%
Eiler	19%	61%	7%
Fowle	27%	52%	18%

The major problem with using the gasoline pump surfaced during the hottest week of the year in July when the pump failed. A pump with a smaller fuel supply was substituted, but because of the problems with the changeover, a substantial fraction of the cottonwoods at Fowle's and Eiler's died. Problems with the pumps plagued the project, and coupled with the fact that the river dried up at Eiler's and Fowle's, eventually resulted in the failure to establish many cottonwoods on the two sites dependent on the pumps. The continuous water supply available at Whipple's through the ranch's well system resulted in high survival percentages and excellent growth of the cottonwoods. The continuous water supply also allowed successful establishment of a later planting in early July, which showed that water availability is more important than the

timing of planting.

Fertilizer was successfully applied through the drip system at all sites using a venturi-type injector which injected at a fixed ratio of 1 part fertilizer to 50 parts water. Unfortunately, the first fertilizer application was shortly before the pump failure and may have contributed to mortality by temporarily elevating the soil salinity during the stress period.

Deer were the major cause of mortality at the Whipple Ranch site. Part of the planting was located in a major summer bedding area for deer. Despite the use of deer protection tubing on all cottonwoods on the site, the deer still managed to push aside the tubes and destroy the some trees, particularly those closest to the bedding areas, and along well established trails. All plants were clipped as soon as they emerged from the 18" tubes.

The large amount of water applied to the Whipple site promoted the rapid growth of weeds (naturally!). Weeds were hoed away from the planted seedlings twice during the growing season. As the seedlings become larger, and grow more rapidly, the weeds will no longer be a problem.

CONCLUSIONS

Water, water, water and more water. An adequate water supply for at least the first growing season allows easy establishment and rapid growth of planted seedlings. A small amount of fertilization is also beneficial but not essential. The water needs to be supplied by a system which is more reliable and easier to manage than a gasoline pumping plant pumping from the river.

The following guidelines should be applied to all future plantings along the Scott River.

1. The sites must have a reliable water supply from well with electric pump available. The amount of water required is relatively small and can therefore be economically piped over a long distance if necessary.

2. The planting spots should be be in the middle of a 24" diameter scalped area free from herbaceous vegetation and grass. Some maintenance may be required during the first growing season to keep the scalped area free of vegetation.

3. Seedlings should have a well developed roots system before planting.

4. Deer protection should be applied immediately after planting where signs of deer activity are apparent. Areas with no apparent signs of deer activity do not need deer protection unless damage occurs.

5. Watering should be a minimum of 2-3 hours per day with 1/2 gallon per hour emitters.

6. Site should be fully saturated with water prior to planting. Cottonwood and willows seem to prefer constant moisture on the sand and gravels soils found on most sites.

Photo 1. Containerized plug seedling

Photo 2. Planting seedlings along drip tubing spacing

Photo 3. Whipple Ranch Site - Field portion

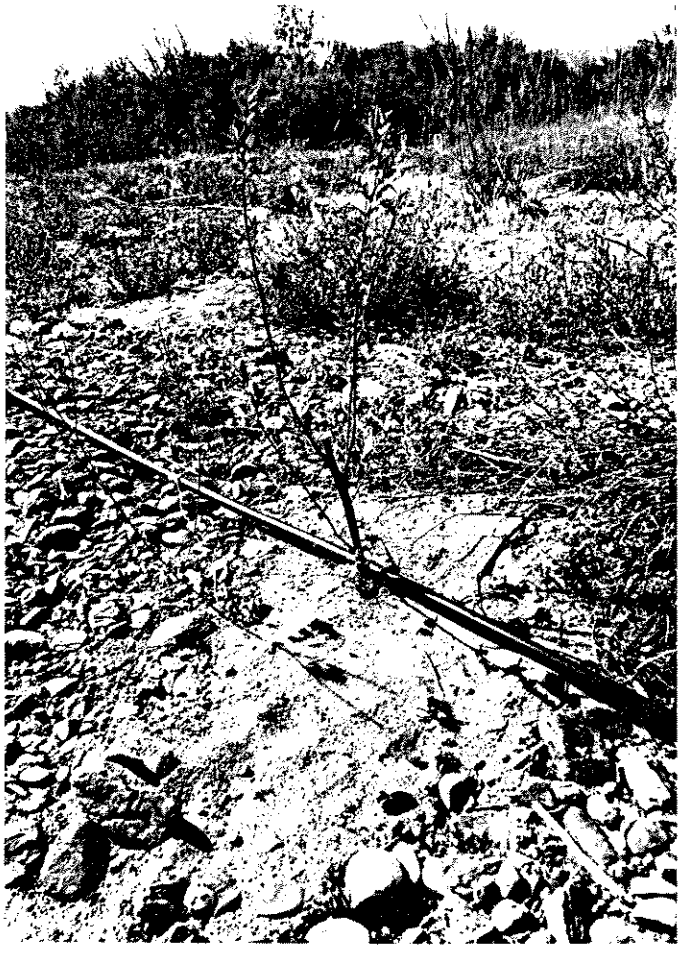


Photo 4. Planted willow, Eiler Ranch

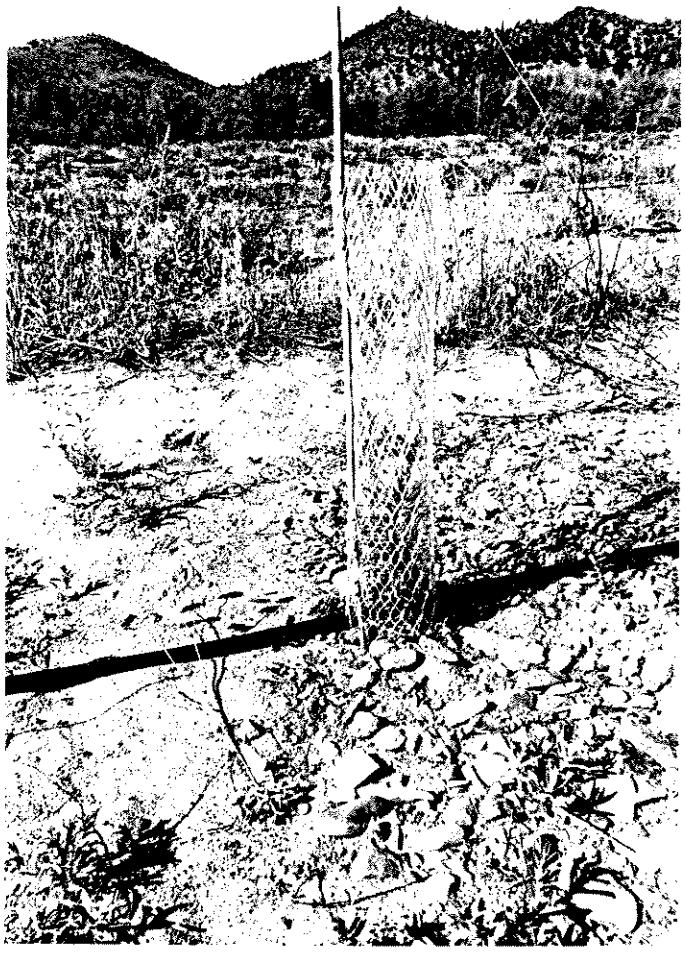


Photo 5. Vexar seedling protector, Eiler site

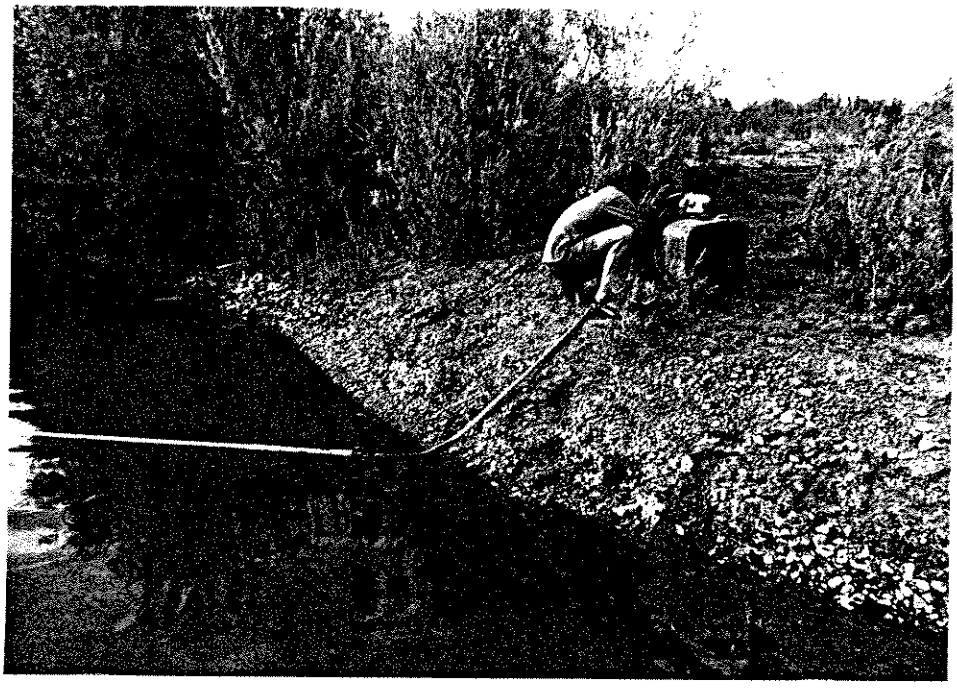


Photo 6. Gasoline pump system, Eiler site

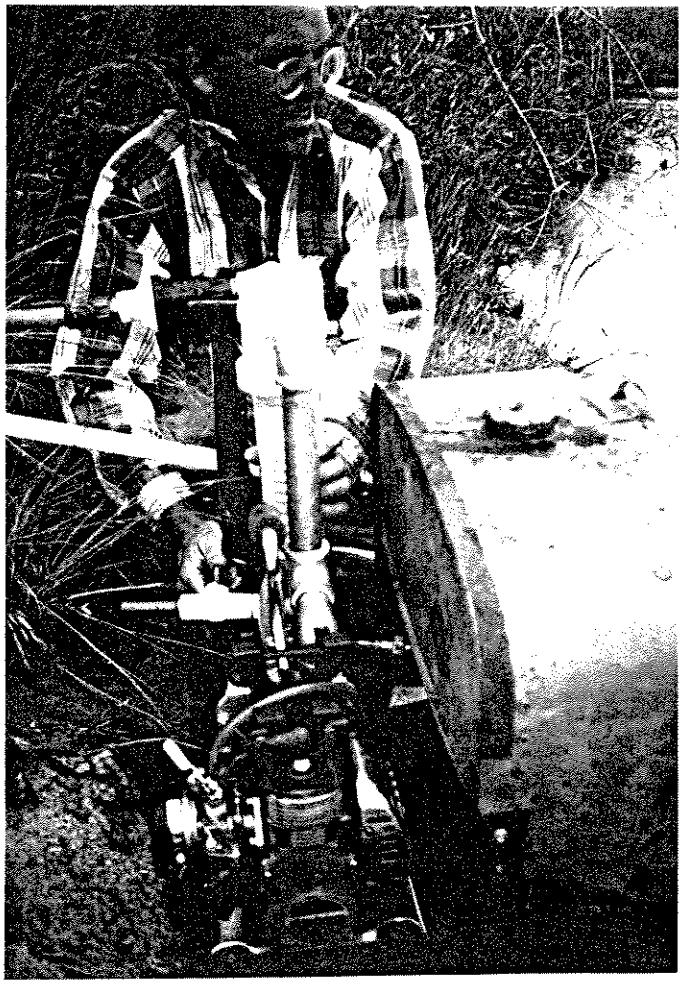


Photo 7. Gasoline pump close-up, Fowle site

Photo 8. Planted pine, Whipple site

Photo 9. Planting site in sand bar, Fowle Ranch

APPENDIX B

Scott River Riparian Woodland Revegetation
FINAL BUDGET - FY 94

PERSONNEL COSTS		
Project Manager: 220 hrs @ $15.00/hr	$3,300.00	
Laborers: 230 hrs @ $8.00/hr	$1,840.00	
Benefits @ 31%	$1,593.40	
TOTAL PERSONNEL COSTS	$6,733.40	
MATERIALS & SUPPLIES		
Plants		$ 980.00
Dripline with emitters	$1,470.00	
Pipe (PVC + fittings)	$ 209.00	
Water pump		$ 710.00
Seedling protectors		$ 151.00
Fertilizer		$ 310.00
Misc.		$ 40.90
TOTAL MATERIALS & SUPPLIES	$3,870.90	
OPERATING EXPENSES		
Transportation	$ 150.00	
Fuel & Oil for pump		$ 180.00
Telephone		$ 40.00
Film		$ 29.70
Misc.		$ 10.00
TOTAL OPERATING EXPENSES	$ 409.70	
SUBTOTAL		$11,014.00
Administrative Overhead @ 10%	$ 1,101.00	
TOTAL		$12,115.00

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